



Fish Management in Fluctuating Reservoirs

By Joe Huston

Fluctuating reservoirs do not provide good habitat for the production of fish, or more simply stated, maintenance of a good fish population in a fluctuating lake is about as easy as trying to grow grass on ground that is covered with water three to six months each year.

Hungry Horse Reservoir is a fluctuating hydroelectric impoundment built on the South Fork of the Flathead River near the town of Hungry Horse, Montana. When full, this reservoir has a surface area of 22,500 acres. The reservoir's level goes down and up depending upon the need for power production and storage for flood control.

Fish found in Hungry Horse Reservoir include cutthroat trout, Dolly Varden, mountain whitefish, longnose and large-scale suckers, northern squawfish, rainbow trout and Arctic grayling. Only grayling were artificially planted in the reservoir. Rainbow trout and grayling are rare, so essentially all species of fish found in the reservoir are native to western Montana.

An overnight gill net sampling of the reservoir's fish population was undertaken in 1959, 1961, 1966 and 1968. In November of each of the four years about 40 overnight gill net sets were made throughout the

length of the reservoir. Total catch for all years combined included 117 cutthroat trout, 521 Dolly Varden, 1,419 mountain whitefish, 648 suckers and 576 squawfish.

Comparison of the average catch per net for all four years gives a long-term view of what has happened to the reservoir's fish population in the ten-year period. The average catch per net for all species was 30.8 fish in 1959, 24.8 fish in 1961,

28.6 fish in 1966 and 15.6 fish in 1968. These figures show that the fish population remained fairly stable from 1959 to 1966 and then dropped about one-half in 1968.

The cause of the 1968 fish decline gets rather complex. Part of the answer lies in the operation of Hungry Horse Reservoir. This reservoir is used for flood control and power production and is subject to water level fluctuations. From 1952 through 1964, the average annual fluctuation was about 50 feet, but in 1965 through 1968, it increased to about 80 feet. The fish capacity of a fluctuating environment is more-or-less



Hungry Horse Reservoir

controlled by the **lowest not by the highest water level.**

A comparison of net catches of game species gives an insight into what has happened in past years and into what may happen in the future. In 1959 the average catch per net of cutthroat trout was 1.1 fish with an average length of 11.7 inches. By 1961 the average net catch was down to 0.8 cutthroat averaging 14.3 inches in length. The decreased catch coupled with the increased size indicates that not enough young fish were being added to the reservoir population.

Inadequate annual propagation of young fish in the lake population started an investigation of the spawning needs of the cutthroat trout. Examination of streams flowing into the reservoir showed that about 20 were **blocked to spawning cutthroat by improper placement of road culverts.** From 1962 through 1965 the Montana Fish and Game Department and the U. S. Forest Service embarked on a joint venture to open several of these blocked streams to spawning cutthroat trout. During these years 10 streams containing about 70 miles of suitable spawning areas were opened to spawning fish. Spawning runs of cutthroat were seen to move into these streams the first year following culvert repair work.

Gill net sampling of cutthroat trout in 1966 and 1968 showed that the average catch per net was increasing and the average size of fish declining. By 1968 the catch rate had increased to 1.0 fish averaging 11.7 inches long; both measurements about the same as those for 1959. This appears to support the previous assumption that production of young fish had been a problem and was at least partially solved by opening up some of the blocked spawning streams.

Catch rates of Dolly Varden netted from the reservoir have also fluctuated from year to year. In 1959 the average catch was 6.9 Dolly Varden per net averaging 15.3 inches long. A declining catch rate coupled with a declining size usually indicates that too many fish are being caught. However, **over-harvest of Dolly Varden from this reservoir is not a problem.** The declining catch rate stems from

the life cycle of this fish and from the impounding of Hungry Horse Reservoir.

Before Hungry Horse Reservoir existed, the South Fork was a major spawning tributary of Flathead Lake. Mature Dolly Varden from Flathead would move into the South Fork in mid-summer, spawn in early fall and return to Flathead Lake in late fall and winter. The eggs these fish laid would hatch, the young fish would spend one to two years in the streams, then move downstream into Flathead Lake to grow to maturity.

When the gates of Hungry Horse Reservoir were closed in August 1952, the only Dolly Varden trapped above the dam were either very young fish or older spawners. Several ages of fish were not in the reservoir when it was filled. By 1959 almost all of the spawners trapped by dam-closure were dead and the majority of the once young fish were now mature. In 1959, as in 1952, several ages were again missing ex-

cept this time the young fish were gone. Between 1959 and 1963 most of the old fish had died, but young fish were again appearing, resulting in a lowered 1966 net catch of 2.2 fish consisting mostly of small Dolly Varden with very few large mature fish. The 1968 catch increased to 3.4 fish and large Dolly Varden were becoming more numerous.

Looking ahead several years, it is expected that large Dolly Varden will be almost as abundant as they were in 1959-1963.

Hungry Horse Reservoir has proven to be one of the few bright spots in management of reservoirs by its ability to produce acceptable game fish populations. Its extensive tributary system, much of which is suitable for game fish reproduction, is invaluable and a feature that no other Montana reservoir has. The department's best estimate at this time is that a population similar to that found in 1968 can be maintained in this reservoir.

MADISON RIVER STUDY

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By Dick Vincent

Until recently, little factual information was available on large streams such as the Madison River.

Newly - developed electrofishing gear has enabled researchers to work effectively on these larger streams. Fish are sampled by introducing an electric current (usually direct current) into the water by means of two electrodes, a positive and a negative. When a fish encounters this electric field, it is forced to swim toward the positive electrode, where it is captured in a dip net and placed in a holding tank. These trout are periodically weighed, measured, tagged and then released. This sampling procedure takes place while floating downstream in a boat.

Estimates of population size come from this "mark-and-recapture" method. The procedure is as follows: (1) one or more electrofishing trips are made down a selected section of river with all captured trout being marked with a fish tag or a fin clip; (2) then four to five days later, one or more electrofishing trips are made

in the same section of the river with all captured trout being examined for tags or fin clips made during the marking period; and (3) the population can then be estimated by determining the ratio of "marked" to "unmarked" fish in the recapture sample.

The following information can be determined from spring and fall population estimates: (1) the number of trout in each age group; (2) the time of year when most trout die; (3) how many trout die each year; and (4) the number of young fish recruited in the population each year. Fish tags returned by anglers can be used to determine what effect the angler has on the trout population.

The initial Madison River fish population study was set up to determine the effect of water flow patterns from Hebgen Reservoir on the wild trout populations. Two sections were selected for study: (1) Varney—located 10 miles upstream from Ennis between Varney Bridge and Eight Mile Ford, and (2) Norris—located below the Beartraps from Hot Springs Creek to Cherry Creek.

Two basic water storage patterns have been used at Hebgen Reservoir:



Electrofishing operations on the Madison River

(1) water storage starts in February or March prior to spring run-off and continues into the spring until full, or (2) storage begins in early May during spring run-off and continues until the reservoir is filled. **When the early storage pattern was used, the portion of the Madison River below Hebgen would be 35-60% dewatered for a two to three-month period.** This seriously reduced the amount of good trout habitat.

Preliminary population data taken during the fall of 1966 and the population estimates made in 1967 indicated that the poor spring flow pattern which had occurred in 1967 had adverse effects on the trout populations in the study section. The smaller trout which were very numerous in the Varney section during the fall sampling were in poor condition and reduced numbers by the spring of 1967. Also, there were few small (yearling) trout in the fall of 1967. During the winter of 1967-1968, the trout population data plus a revised

flow plan was presented to the Montana Power Company. They agreed to adjust their operation of Hebgen Dam to insure better early spring water flow patterns for 1968 and future years.

Since the change in flow patterns, the Norris section has shown tremendous increases in the trout population. The overall population (two-year-olds and older) has doubled, and the larger trout (one pound and larger) have increased two and one-half times. Both brown and rainbow trout are abundant, with browns comprising 70 per cent of the population.

The Varney section has not shown these remarkable increases. The only significant change was a threefold increase in small yearling brown trout (6 to 10 inches) appearing in the fall estimates after 1967, but by the following spring these trout had suffered an abnormally high mortality. This accounts for the poor recruitment into the catchable fish population. The Varney population is composed primarily of brown trout (90 per cent). At the start of the study in 1967, the Norris section had five times as many catchable wild trout per mile as the Varney section, and by the spring of 1970 it had 11 times as many per mile.

What are the reasons for the large differences in the trout populations between the two study sections? Some factors which **could** affect trout

numbers are: condition of the habitat, pesticides, water pollution, fishing pressure, angling regulations, and stocking of hatchery fish.

Condition of the habitat can be extremely influential on trout numbers and their ability to survive. Such things as stream realignment, bank erosion, removal of brush along stream banks, and removal of stream bottom materials can cause substantial losses in fish numbers. Trout habitat in the Norris section is better than Varney which could explain part of the initial differences in numbers, but it doesn't explain why the Norris section was able to double after flow improvement while the Varney population stayed the same. Since the Varney population did not increase, some other factor(s) must be restricting trout numbers.

The effects of pesticides and water pollution can seriously suppress trout numbers. At the present time, the presence of a pesticide or a pollutant has not been determined—although if one or both are present in the Varney area, they should be present in the water in the Norris section.

Estimates of annual fishing pressure for the two study sections show that the Norris section has a higher fishing pressure per mile than Varney. This indicates that angling at the present levels has little or no effect on existing populations.

One of the major differences in the two study areas is that the Norris section has not been stocked since 1960, while the Varney section has received heavy plants for many years. **There is a possibility that the stocking of catchable trout may have some detrimental effect on wild trout populations.** This possibility is the basis for the second phase of the Madison River study.

The second phase of the study started in the spring of 1970. The purpose of this study is to determine the effect of fish stocking on wild trout populations, and is in two parts. First is to stock a section which hasn't received hatchery trout for four to five years (a section of O'Dell Creek) and second to cease planting an area that has been planted for at least four to five years (Varney section of the Madison River). These populations will then be studied during 1970 and 1971.

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AIRPLANE PATROLS

By Jim Ford

For many years the airplane has helped game wardens and biologists protect and enhance Montana's fish and game populations.

In the spring, wardens use the plane for early season patrols to spot fishermen that are "jumping the gun". Some of the boys who think they got out there all by themselves get a very surprised look on their faces when the warden flies over.

Biologists use airplanes for spring and summer census work. An example of this is the annual antelope count which is made prior to setting hunting quotas.

Another summertime use of the airplane is fishermen surveys. These surveys are flown each year to help both enforcement and fisheries people in their work. Surveys of this type when done in conjunction with ground work, can be a very effective management tool.

Aerial planting of fry and finger-

ling fish in many high mountain lakes is another Fish and Game program. Aerial planting is the most reliable and economical way of stocking these lakes.

During the late summer, the illegal practice of spotlighting game starts to pick up. The airplane is very instrumental in detecting and apprehending these people who have no concern for the law or the future of game populations. Since such a large area can be monitored, an airplane working in conjunction with ground crews can apprehend almost any suspect.

On certain occasions, it may be useful to follow a suspect at night without his knowledge. An example of this occurred near Great Falls. Local wardens knew a suspect was going out to retrieve a poached elk during the early morning hours. The poacher was easily followed with an airplane over back roads and highways until he was apprehended by a ground crew.

During the hunting season, airplane patrols are conducted by both the biological and enforcement personnel in areas of large hunter con-

centrations. By these patrols, biologists obtain some information on the kill in these areas, and wardens direct ground personnel to areas of large kills and suspected violations.

After the snow flies, the plane is used extensively for censusing big game animals on their winter ranges. Trend counts, distribution, movements and concentrations can also be determined by these winter flights.

In the snow, a poacher's trail is very readable from the air as many offenders have discovered. It is almost impossible for a poacher to shake an airplane from his trail. After a short period of ground-to-airplane radio correspondence, the poacher is usually apprehended.

Some other uses made of the airplane in Fish and Game work include distribution of fish toxin for stream and lake rehabilitation, herding animals into the trap on trapping operations, herding animals on game damage complaints, search and rescue work, cooperation with the sheriff's offices or other law enforcement agencies, beaver cache counts, duck counts, and transportation.

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